

REMARKS

Claims 1-3, 5, 6, and 8 are presently pending in the application.

Claims 1 and 2 have been amended to positively recite that component (D) comprises an amine phosphite salt of a phosphorous acid ester and that the upper limit of sulfated ash content in the composition is 0.59 percent by mass. Support for these amendments may be found in the specification at least in paragraphs [0011] and [0058] and at page 17 in Example 6 in Table 1. No new matter has been added by these amendments, and entry is respectfully requested.

*The Presently Claimed Invention and §132 Declaration*

As previously explained on the record, the presently claimed invention is directed to a lubricating oil composition for an internal combustion engine, specifically, a low ash content-type diesel engine oil suitable for use in a diesel engine equipped with an exhaust gas after-treatment device. It is known in the art that some engine oils tend to shorten the life of the exhaust gas after-treatment device. For example, when using oils containing ZnDTP, which is generally added as an anti-wear agent, zinc oxides or zinc phosphates derived from ZnDTP accumulate on the catalyst surface or filter during combustion and thus impair the purifying performance of the device. Therefore, it has been desirable to minimize or eliminate the amount of ZnDTP in such oils. It is also known that metallic detergents cause similar problems to those resulting from ZnDTP.

However, due to mixing in of soot and contaminating oils, particularly in diesel engines equipped with an exhaust gas recycling system, reducing or eliminating ZnDTP and/or metallic detergents increases the wear of the valves and deteriorates the detergency of the oil for the pistons. Therefore, it would be desirable to provide a low ash-content type engine oil which exhibits enhanced antiwear properties and high temperature detergency even when the amounts of ZnDTP and/or metallic detergents are reduced.

Applicants have discovered that by adding component (D), i.e. amine salts of phosphorous acid esters (amine phosphite salts, as recited in claim 1) or by adding these amine salts in combination with component (E), i.e., a fatty acid amine (as recited in claim 2) to an engine oil which comprises a base oil, (A) a succinimide-based ashless dispersant, (B) a metallic detergent, and (C) a zinc secondary alkyldithiophosphate, all in particular amounts, and by

adjusting the sulfated ash content of the oil to 0.3 to 0.59 percent by mass, an engine oil exhibiting the desired properties may be achieved.

Including amine phosphate salts in such low ash-content engine oil compositions does not provide the same improved anti-wear properties and high temperature detergency as including the claimed amine phosphite salts. In order to demonstrate the difference between amine phosphate salts and amine phosphite salts, Applicants have performed additional comparative experiments. These experiments are described in a (Second) Declaration Under 37 C.F.R. § 1.132 of Isao Kurihara ("Second Kurihara Declaration"), submitted herewith.

As set forth in paragraph 6 of the Second Kurihara Declaration, three comparative oils (Reference Examples 4-6) were prepared by the method described at page 30, line 17 to page 32, line 12 of the specification. The components of each of the Reference Example oils are summarized in Table B of the Second Kurihara Declaration, which also includes the compositional details of Reference Examples 1-3 (described in the (First) Kurihara Declaration filed in this application) and Inventive Examples 2, 6, and 7 (labeled "Ex. 1, Ex. 2, Ex. 3") for comparison. The compositions of Reference Examples 4-6 were prepared by replacing the amine salt of phosphorous acid ester used as Component (D) in the compositions of Inventive Examples 2, 6, and 7 with an amine salt of phosphoric acid ester, and adjusting the phosphorus concentrations to the same levels as those of the respective Inventive Examples. Thus, the only difference between the compositions of Reference Examples 4-6 (comparative) and Inventive Examples 2, 6, and 7 is the specific component (D) which is included: an amine salt of phosphoric acid ester (amine phosphate, Reference) or an amine salt of phosphorous acid ester (amine phosphite, Inventive).

As shown in Table B, the composition of comparative Reference Example 4, which contains an amine salt of phosphoric acid ester as component (D), exhibited inferior high temperature detergency in the Hot tube test to the composition of Inventive Example 2, with comparable anti-wear properties in the High-velocity four-ball wear test. Further, the compositions of comparative Reference Examples 5 and 6 exhibited poorer anti-wear properties in the High-velocity four-ball wear test than the compositions of Inventive Examples 6 and 7, respectively, with comparable high temperature detergency in the Hot tube test.

In summary, each of the comparative oils of Reference Examples 4-6 was inferior to that of Inventive Examples 2, 6, and 7, respectively, in either anti-wear properties or detergency at high temperature. Thus, for oils having a sulfated ash content of 0.3 to 0.59 mass %, the test results demonstrate that addition of an amine salt of phosphoric acid ester (amine phosphate salt) does not improve anti-wear properties or detergency at high temperature. In other words, optimization of both high temperature detergency and anti-wear properties in the presently claims oils may only be achieved by including an amine salt of phosphorous acid ester (amine phosphite salt), but not an amine salt of phosphoric acid ester (amine phosphate salt), as component (D). The nature of component (D) is thus critical for improving the properties of the resulting lubricating oil compositions.

*Rejection Under §103(a) Based on Nakazato in view of Griffith*

The Examiner has rejected claims 1-3, 5, 6, and 8 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,569,818 of Nakazato et al. ("Nakazato") in view of U.S. Patent No. 5,552,068 of Griffith ("Griffith"). The Examiner again argues that Nakazato discloses a lubricating oil composition having low phosphorus (P) content of 0.01 to 0.1 weight % and a sulfated ash of 0.1 to 1 weight %, which is comprised of: (a) a major amount of mineral base oil having a low sulfur (S) content of at most 0.1 weight %, (b) an ashless alkenyl or alkyl-succinimide dispersant or derivative thereof in an amount of 0.01 to 0.3 weight % in terms of nitrogen atom content, (c) a metal-containing detergent such as an overbased alkaline earth metal salt of an alkyl salicylic acid in an amount of about 0.2 to 7 weight %, (d) a zinc dialkyl-dithiophosphate in an amount of 0.01 to 0.1 weight % in terms of a phosphorus content, and (e) an oxidation inhibitor. Nakazato allegedly teaches that the lubricating oil composition may be used in internal combustion engines such as diesel engines equipped with exhaust gas after treatment systems.

The Examiner argues that the open ended claim language in the present claims allows for the addition of other additives to the oil compositions, such as the oxidation inhibitor component of the prior art. Further, Nakazato allegedly teaches that the lubricating oil compositions may contain other auxiliary additives, such as phosphoric acid esters, phosphorous acid esters and organic amide compounds such as oleylamide. The Examiner acknowledges that

Nakazato does not teach or suggest amine salts of phosphoric acid esters and amine salts of phosphorous acid esters as claimed, but contends that such amine phosphate salts are known in the art as extreme pressure/anti-wear agents as evidenced by Griffith.

Specifically, the Examiner argues that Griffith teaches a lubricating oil composition having balanced antiwear/extreme pressure and stability properties while providing friction reduction which comprises: (1) a major amount of a lubricating oil basestock and (2) a minor amount of an amine phosphate salt of formula (I). Griffith allegedly teaches that the composition may be used as an automotive lubricating oil and that the amine phosphate may be present in an amount of from 0.01 to 10 weight %. The Examiner concludes that it would have been obvious to add the amine phosphate salt of Griffith to the oil composition of Nakazato if the additive's known imparted properties were so desired.

Finally, in response to Applicants' previous arguments and 132 Declaration, the Examiner argues that amine salts of phosphorous acid esters are known in the art to act as extreme pressure agents and as anti-wear agents in lubricating oil compositions. The Examiner thus concludes that it would be expected that different anti-wear agents (phosphites and amine phosphate salts) would have differing results in anti-wear performance, and that the results which were demonstrated by Applicants are not sufficient to overcome the case of *prima facie* obviousness. Applicants respectfully traverse this rejection as follows.

Nakazato teaches a low ash-content type engine oil composition containing sulfated ash in an amount of 0.1 to 1 wt % and having high temperature stability (detergency and oxidation stability). Nakazato only exemplifies oils having a sulfated ash content of 0.6 weight % or greater, and does not suggest that utilization of 0.3 to 0.59 wt % sulfated ash provides effective high temperature detergency.

Further, the Nakazato lubricating oil composition comprises: (a) a mineral base oil, (b) an ashless succinimide dispersant, (c) a metal-containing detergent, (d) a zinc dialkyl-dithiophosphate, and (e) an oxidation inhibitor. Nakazato further teaches that the composition may contain phosphoric acid esters, phosphorous acid esters, and organic amide components, such as oleylamide. However, as acknowledged by the Examiner, Nakazato does not teach or suggest an amine phosphite salt (amine salt of phosphorous acid ester) as claimed. Further, Griffith does not cure the deficiency with Nakazato. Griffith teaches lubricating oil

compositions containing amine phosphate salts having a particular formula. Griffith teaches that such amine phosphates improve the extreme pressure, antiwear, and stability properties of oils, as well as providing friction reduction (col. 1, lines 58-63). Griffith does not teach or suggest that amine phosphite salts as claimed may be included in the composition.

As demonstrated in the Second Kurihara Declaration, amine phosphates (as taught by Griffith) and amine phosphites (as claimed) are not equivalent in the properties they provide to lubricating oil compositions. Therefore, it would not have been expected based on Nakazato, Griffith, or the proposed combination thereof that utilization of an amine phosphite salt as compound (D) in the presently claimed compositions would provide superior and unexpected high temperature detergency and anti-wear properties. In sum, the proposed combination of Nakazato and Griffith would not teach or suggest all of the claimed elements, namely, a lubricating oil composition containing, among other components, amine salts of phosphorous acid esters (amine phosphite salts) as phosphorus-containing ashless anti-wear agents. Further, the results exhibited by Applicants' presently claimed compositions containing such components and a sulfated ash content of 0.3 to 0.59 % by mass would not have been expected based on the proposed combination of references. Accordingly, any *prima facie* case of obviousness which were to be established would be overcome, and reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

Rejection Under §103(a) Based on Yagishita in view of Nakazato and Griffith

The Examiner has rejected claims 1-3, 5, 6, and 8 under 35 U.S.C. §103(as ) as being unpatentable over U.S. Patent No. 6,306,801 of Yagishita ("Yagishita") in combination with Nakazato and Griffith. The Examiner again argues that Yagishita discloses a lubricating oil composition suitable for use as a diesel engine oil which comprises a major amount of a lubricating base oil selected from mineral oils and synthetic oils and, as additives, (A) 0.5 to 20% by mass of acylated bissuccinimide, (B) 0.05 to 0.3 % by mass of zinc dithiophosphate in terms of phosphorus content, and (C) 0.5 to 3.0% by mass of metallic detergent in terms of sulfate ash content, based on the total mass of the composition. Yagishita allegedly teaches that the metallic detergent component may be an overbased alkaline earth metal salicylate having a total base number of 100 to 450 mg KOH/g. The Examiner acknowledged that Yagishita does not teach

the addition of a phosphorus-containing ashless antiwear agent or adding a fatty acid amine to the lubricating oil compositions. However, the Examiner argues that Yagishita allows for the addition of known additives to the compositions, including antiwear agents.

Further, based on the alleged teachings of Nakazato described above, the Examiner argues that it would have been obvious for one skilled in the art to have added any conventional engine oil additives, such as those taught by Nakazato, to the lubricating oil compositions of Yagishita if the known imparted properties were so desired. The Examiner also takes the position that it would have been obvious to add the amine phosphate salts of Griffith, described above, to the oil composition of Yagishita, if the additive's known imparted properties were so desired.

Finally, in response to Applicants' previous arguments and 132 Declaration, the Examiner argues that amine salts of phosphorous acid esters are known in the art to act as extreme pressure agents and as anti-wear agents in lubricating oil compositions. The Examiner thus concludes that it would be expected that different anti-wear agents (phosphites and amine phosphate salts) would have differing results in anti-wear performance, and that the results which were demonstrated by Applicants are not sufficient to overcome the case of *prima facie* obviousness. Applicants respectfully traverse this rejection as follows.

Yagishita discloses lubricating oil compositions suitable for use in diesel engines. These compositions contain a lubricating base oil, (A) 0.5 to 20% by mass of an acylated bisuccinimide, (B) 0.05 to 0.3 mass % of ZnDTP in terms of phosphorus content, and (C) 0.5 to 4.0 mass % of a metallic detergent in terms of a sulfated ash content, based on the total mass of the composition. The sulfated ash content in the Yagishita compositions is thus at least 0.624 mass % (total of the sulfated ash content (P) derived from ZnDTP and that of the metallic detergent), which exceeds the claimed upper limit of sulfated ash of 0.59 mass %. Yagishita thus does not teach or suggest the claimed sulfated ash content, nor would there have been any motivation to reduce the sulfated ash content of Yagishita to obtain a low ash content composition as claimed.

Additionally, as acknowledged by the Examiner, Yagishita is silent as to the use of an amine phosphite salt as a phosphorus-containing ashless anti-wear agent, and even the proposed combination with Nakazato and Griffith would not cure the deficiency with Yagishita. As

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previously explained, neither Nakazato nor Griffith teaches or suggests amine phosphate salts of phosphorous acid esters. Therefore, even the proposed combination of Yagishita and Nakazato and Griffith would not teach or suggest all of the claimed elements. Finally, the results exhibited by the presently claimed compositions, which contain an amine phosphite salt and have a sulfated ash content of 0.3 to 0.59 mass %, would not have been expected based on the proposed combination of Yagishita, Nakazato, and Griffith. Accordingly, any *prima facie* case of obviousness which were to be established would be overcome, and reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

In view of the preceding Amendments, Remarks, and Second Kurihara Declaration, Applicants respectfully submit that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,  
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February 29, 2008 By: [Signature] Reg No. 25,918  
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Enclosures: Petition for Extension of Time (one-month)  
(Second) Declaration Under § 1.132 of Isao Kurihara